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Sector level cost of equity in African financial markets

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ABSTRACT

This paper assesses the effectiveness of Liu (2006) metrics in measuring illiquidity within a multifactor CAPM pricing model. Costs of equity are estimated using this model for the major sectors within Africa's larger equity markets: Morocco, Tunisia, Egypt, Kenya, Nigeria, Zambia, Botswana and South Africa. In all countries, the cost of equity is found to be highest in the financial sector and lowest in the blue chip stocks of Tunisia, Morocco, Namibia and South Africa. At an aggregate level, Nigeria and Zambia have the highest cost of capital.

1. Introduction

The establishment and development of equity markets across African since the demise of the Cold War and subsequent restructuring of global capital flows has been driven by the need of many countries to attract foreign investment. Foreign Direct Investment (FDI) and portfolio investment are essential to supplement low domestic savings rates and are generally encouraged, despite political concerns about potential loss of sovereignty of national assets and vulnerabilities associated with financial contagion. African securities markets have achieved significant levels of institutional development during the last decade and strive to provide attractive and competitive venues for firms seeking to raise funds for much needed industrial and development projects. However, extreme illiquidity and segmentation are major

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concerns for both potential investors and firms as they attempt to source cheap capital and diversify ownership through domestic listing (Lesmond, 2005; Hearn and Strange, 2009).

Africa is a particularly interesting region in which to study securities markets given the current drive towards integration that is being actively pursued by regional bodies such as the New Africa Partnership for Development (NEPAD) and African Stock Exchanges Association (ASEA). There is a wide variety of markets at very different levels of development, from South Africa, which is the largest and most developed to the fledgling markets of Lusaka (Zambia) and Botswana. Contrasting levels of regulation and regulatory enforcement are reflective of the considerable variation in development amongst the continent's financial markets. Another factor that adds an intriguing dimension is the mix of legal regimes, with North and some West African markets influenced by French civil code (La Porta et al., 2008), as opposed to English common law in many other countries. Finally, a distinguishing feature in East Africa is the development underway in Kenya, which is preparing to act as a regional integrated hub market.

By its nature, liquidity is a difficult concept to define, largely due to its ability to transcend a number of properties associated with market transactions, such as tightness, depth, resiliency (Lesmond, 2005) and information (O'Hara, 2003). Empirically defined constructs designed to capture liquidity centre on measuring direct trading costs, such as tightness, by the bid–ask spread (quoted or effective) and indirect trading costs that are linked to depth and resiliency, which are often represented by price impact measures. The lack of reliable and consistent bid–ask quotes in many emerging markets suggests the use of market activity proxies in capturing liquidity, and there is little consensus regarding the appropriateness of using common measures such as turnover and, more recently, the price impact variable developed by Amihud (2002) (Lesmond, 2005).

However, the importance of including a measure of liquidity in pricing models and cost of equity analysis is supported by the poor performance of single-factor pricing models, particularly in emerging markets. Collins and Abrahamson (2006) provide costs of equity estimates for a variety of African markets but the analysis falters on the various forms of one-factor relationships used to model industry sector time series. The presence of severe illiquidity suggests a high degree of price rigidity, which lowers both variances and covariances between series (Hearn and Piesse, 2009), adding a significant bias in the betas, or their proxies, in CAPM type pricing models. Equally, costs of equity estimated through standard one-factor CAPM models (Correia and Uliana, 2004) fail to take into account the well documented effects of size and liquidity in explaining the cross section of returns (Martinez et al., 2005). Similar concerns relate to a study by Mishra and O'Brien (2005) that estimates the cost of equity using a two factor model at the firm level for 16 emerging markets that are included in the S&P Emerging Market Database (EMDB) (formerly IFC EMDB). This takes into account the market portfolio (MSCI World) and a political risk factor that relates the volatility of individual stocks to the volatility of the market. However, the implicit assumption that emerging markets are integrated with the global market portfolio and the omission of liquidity risk, which largely explains political risks, are particular sources of concern (Lesmond, 2005).

While the literature on the importance of liquidity has developed over the past decade, research on liquidity risk and its applications is much more recent. Pastor and Stambaugh (2003) find evidence that leveraged investors that face solvency constraints require higher expected returns for holding assets that are difficult to sell when aggregate liquidity is low. Furthermore, stocks with a higher sensitivity to aggregate liquidity generate higher returns than low-sensitivity stocks, suggesting that liquidity is an important variable in asset pricing. Additionally a serious caveat in asset pricing and the ability to capture the cross section of stock returns arises from the inability of either the traditional one-factor CAPM or its three-factor counterpart, including sixe and book-to-market factors as proposed by Fama and French (1993) (Liu, 2006). Liu (2006) and Daniel and Titman (1997) find considerable evidence of the limited explanatory power of the Fama and French model to capture the cross section of asset returns. Martinez et al. (2005) also present evidence of the limited explanatory power of the Fama and French three-factor model, although there is some evidence of some explanatory power in retaining the size factor. Finally, Jun et al. (2005) find evidence that stock returns in emerging markets are positively related to liquidity.

In addition to questions regarding the benefits of the book-to-market variable there are serious limitations to getting consistent accounting book values for firms in emerging markets. Emerging stock markets are highly skewed with many dominated by a handful of large firms while the rest are small and medium sized enterprises. Thus, a size factor should be retained within the pricing model to explain the cross section of returns. This study finds evidence that the liquidity and size factors are significant in

explaining the cross section of returns and outperforms the traditional CAPM. Given that a liquidity factor better captures the risks attributable to firm distress and solvency issues than the additional book-to-market valuation factor of the Fama and French (1993) model (Liu, 2006) this study augments the standard CAPM with both size and liquidity factors. The success of this multifactor CAPM provides support for the continued use of the risk–return paradigm in asset valuation.

This paper is structured as follows. Section 2 has three parts: the first gives an overview of the institutional features of Africa's markets; the second introduces the liquidity measures and their construction; and the third discusses data specific issues. Section 3 outlines the three-factor size and liquidity augmented CAPM and Section 4 presents the empirical results. The final section concludes and outlines the impact these finding may have on development policy.

2. Equity markets and liquidity measurement

2.1. Securities markets

The principal characteristics of these markets are summarised below and in Tables 1 and 2 (see Piesse and Hearn (2005) for an extended discussion of African stock markets).

2.1.1. North Africa

The Egyptian stock exchange is one of the oldest and was formed by the integration of the Alexandria Stock Exchange, established in 1888, and the Cairo Stock Exchange, established in 1903. Trading is

Table 1
Market capitalisation and turnover profiles, 2008.
Source: Compiled by authors from Bloomberg.

	North Africa			West Africa	East Africa	Southern Africa			
	Egypt	Tunisia	Morocco*	Nigeria	Kenya	South Africa†	Namibia**	Zambia	Botswana
Listed firms	302	53	78	234	46	373	8	24	20
Proportion market capitalisation to total (%)									
Top 1	7.43	12.51	27.55	8.40	21.02	8.31	55.55	18.12	22.29
Top 5	29.64	43.56	57.81	27.08	63.67	30.36	99.12	73.22	77.65
Top 10	43.58	65.23	74.29	44.38	78.79	45.44	100.00	96.20	92.87
Top 20	59.69	88.20	88.88	64.33	94.31	62.31	–	98.50	100.00
Proportion turnover value to total (%)									
Top 1	11.50	9.69	19.42	9.00	20.44	12.74	46.77	32.85	18.52
Top 5	36.81	38.19	58.92	36.45	56.73	42.19	100.00	92.49	68.53
Top 10	55.31	61.98	78.00	52.66	74.76	59.67	100.00	98.71	94.55
Top 20	78.67	86.51	92.01	69.59	95.78	76.28	–	99.00	100.00
Sector concentration by market capitalization									
Financials	24.72	57.38	42.04	59.74	46.90	28.11	70.45	18.25	85.33
Comm.	18.22	0.31	27.55	1.37	0.96	14.09	–	18.12	–
Basic materials (mining etc)	14.63	3.89	3.37	0.53	1.63	23.86	–	–	–
Consumer-cyclical	5.00	12.16	2.55	2.81	4.73	6.52	–	1.22	3.04
Consumer non-cyclical	6.59	8.92	4.35	17.79	26.95	6.63	21.12	37.93	8.84
Diversified	1.57	12.51	7.39	1.57	0.08	4.27	8.42	–	–
Energy	1.03	0.38	1.46	10.41	4.41	9.50	–	3.43	2.65
Industrial	18.86	4.45	9.93	5.35	14.33	5.58	–	15.48	0.07
Technology	0.12	–	0.14	0.02	–	0.31	–	–	0.05
Utilities	0.18	–	1.23	–	–	0.00	–	5.53	–

Notes: (1) *Refers to Central Market and Block Trading Market.
(2) †Refers to both Johannesburg Stock Exchange main board and the Alternative Investment Market, ALTx.
(3) **Refers only to local primary listed stocks. 68% of stocks listed on NSX have their primary listings elsewhere.

Table 2
Contrast of market regulations and commissions.

	Commercial law	No. brokers	Market clearance procedures	Capital gains tax	Trading hours	Trading arrangements
South Africa	Common law	101	Fully G30 compliant including custodial facilities. DVP undertaken T + 3	Exempt	8:25 am–9:00 am: pre-opening electronic call auction. 9:00 am–4:00 pm: continuous trading. 4:00 pm–6:00 pm: run-off	JSE SETS electronic trading system (SETS trading system has been in place at the London Stock Exchange and replaced the former JET system in 2002)
Namibia	Common law	6				
Kenya	Common law	18	Partial G30 compliant. DVP undertaken T + 3.	Exempt	10:00 am–12:00 noon	Automated trading system — previously open outcry commenced by sounding a bell
Egypt	Civil code	146	Fully G30 compliant including custodial facilities. DVP undertaken T + 3.	Exempt	Listed securities market (on the Exchange): 11:30 am–15:30 pm	Electronic order matching system for Cairo and Alexandria Stock Exchanges (CASE) — the CASE trading system, or CTS
Morocco	Civil code	15		Exempt		Electronic continuous auction system. Secondary market trading is segmented into blocks: continuous market; block market (for large institutional trades); development market (for SMEs)
Tunisia	Civil code	24		Exempt	9:00 am–10:00 am: pre-opening// 10:00 am–11:30 am trading session	Electronic order matching system
Nigeria	Common law	219	Custodial facilities provided by brokers with sufficient capitalisation. Mostly G30 compliant and DVP undertaken at T + 3	Exempt	11:00 am–13:00 pm	Call Over trading system was replaced in April 1999 by automated trading system (ATS) which serves as an electronic order matching system
Zambia	Common law	3	Partial G30 compliant. DVP undertaken T + 3.	Exempt	9:00 am to 10:00 am: pre-opening// 10:00 am–13:00 pm trading session	Automated trading system (continuous auction)
Botswana	Common law	4		Exempt	10:00 am–12:00 pm	Electronic call auction conducted in trading room within exchange building.

Note: (1) South Africa and Namibia adhere to Roman–Dutch civil code but commercial and securities regulatory law follows English common law.

electronic and between floor-based members of local brokerage firms and takes place in three markets: an OTC market, a Primary Dealers Bonds market, and a Listed Securities market. The latter has a pre-opening session from 9:45 am to 10:15 am followed by continuous daily trading between 10:30 am and 14:30 pm. A central depository exists to assist settlement, which is largely in compliance with G30 recommendations[1] and a number of large, well capitalized, custodian banks support overseas investors (CASE website, 2009). Significant improvements have been made to market regulations and the universal adoption of corporate governance and accounting standards, which through their costly implementation caused a dramatic reduction in listings in 2004 (CASE website, 2009). However many of the listed firms are smaller in size and dominated by either family stakeholders or blockholders and only a small handful of firms such as Orascom have been able to meet the more stringent regulatory requirements and dual list shares or depository receipts on major overseas exchanges. The code of corporate governance established in 2003 was set up by a committee formed from CASE and the largest 10 companies to enshrine the best principles of OECD guidelines and despite the considerable progress that has been made there remains significant ambiguity in firm's interpretation of the various directives designed to ensure market transparency (Fawzy 2003).

The Bourse de Casablanca, Morocco, was established in 1929. Trading is electronic with terminals located in the local brokerage community. Settlement is G30 compliant by MAROCLEAR, the national CSD established in 1998 (Bourse de Casablanca website, 2009). Trading is reported electronically to local market participants and to international data vendors such as Bloomberg and Reuters. This gives the market the opportunity to attract overseas investors. Stock market awareness is high and the exchange is used as a successful route for domestic flotation, although it also attracts significant retail and institutional investors. Corporate governance legislation in Morocco, alongside the rest of North Africa, has undergone a considerable modernization in line with the changes in political, economic and administrative governance institutions. However, formal legislation, in the form of a Moroccan Code of Corporate Governance Practices, has only very recently been enacted in February 2007 through the establishment of a National Commission of Corporate Governance in Casablanca (National Commission on Corporate Governance 2008). This has overseen the legal codification of corporate governance in the Kingdom, which largely follows the OECD best practice guidelines.

The Bourse de Tunis was established in 1969. Trading is electronic and was introduced in 1996 with the assistance of Euronext Paris. The trading system is split into fixing and continuous systems, with the former handling small and illiquid securities and comprised of a series of sequential electronic call auctions (Bourse de Tunis website, 2009). Trading hours in the continuous market are 9:00 am to 14:10 pm in the months outside July, August and during Ramadan where hours are 8:30 am to 12:10 pm. Settlement is fully G30 compliant. Overall market regulation is well designed through considerable French and EU assistance and corporate governance, in line with Morocco, adheres to OECD best practice guidelines. However, there is little of a domestic stock market culture and only around 5% of finance raised by firms in 2007 was done so through the stock exchange (Zribi, 2008).

2.1.2. West Africa

The Nigerian stock exchange is the largest and most active stock exchange in the West African region[2] and was originally established in 1960 in Lagos with a mere 19 listed firms. The exchange now has several branches around the country including Kaduna (established in 1978) and Port Harcourt (established in 1980) (Nigerian stock exchange website, 2009). However serious concerns over the small and fragile formal business sector in Nigeria together with intense political lobbying caused the early closure of the

[1] G30 relates to the Group of Thirty which is the most influential body to encourage the standardisation and improvement in global securities administration. Following a symposium in London in March 1989, the following recommendations were agreed: i) Brokers should match trades on day after deal date ($T+1$); ii) Trade confirmation on trade day plus 2 days ($T+2$); iii) Central Depository for safe keeping of shares; iv) Net basis settlement of cash and stock; v) Settlement takes place as delivery vs. payment or receipt vs. payment; vi) Settlement in same day funds; vii) Settlement effected on trade date plus 3 days ($T+3$) 8; viii) Securities lending should be permitted; and ix) International securities numbering system must be adopted (ISIN code).

[2] There are also much smaller stock exchanges in Ghana, Cote d'Ivoire (acting as a regional exchange for Francophone member states of Union Monétaire et Économique de l'Afrique de l'Ouest (UMEAO)), and Cape Verde Islands, but these are omitted from this study due to their size and extreme illiquidity (see Lavelle (2001) and Hearn and Piesse (2009) for a detailed discussion of these markets).

country's second stock exchange in Abuja in 2001 with the institutions being transferred to support the newly created Abuja Commodities Exchange (Abuja Commodities Exchange website, 2009). Trading activity is concentrated in Lagos and is undertaken by an automated trading system (ATS) on a daily basis from 11:00 am to 14:00 pm. Settlement is partially G30 compliant, with a CSD created in 1992 and international custodian banks (Nigerian stock exchange website, 2009). The network of 219 brokers to support the 234 listed firms ensures it is the largest market in West Africa and although trading activity and capitalization is less concentrated than neighbouring markets the financial sector accounts for 59.74% of market capitalization, as seen in Table 1. However, although internationally recognised auditors and accountants are present there are considerable differences in the use of International Accounting Standards (IAS) in listed firms. Many poorly capitalized firms are unable to afford the high fixed costs of professional auditing and there are many ambiguities concerning the use and overlap of Nigerian accounting standards and IAS. Consequently, corporate governance is a costly luxury for those few firms that have sufficient capitalization to comply.

2.1.3. East Africa

The Nairobi Stock Exchange (NSE) was first established as an informal share market during the 1920s before being incorporated in 1954. Since 1994, the market has occupied the same premises as the CSD and The Nation, which is the business journal that disseminates trading information. Trading takes place daily between 10:00 am and 12:00 by a central electronic book entry system, and is limited to the floor of the exchange. The market is dominated by blockholders and smaller retail investors and free float percentages are low[3]. Order flow to the market is by a small network of licensed stock brokers and their regional affiliates. Investors are required to establish both a trading account with the broker and a separate individual account at the central depository. Public releases of shares in the primary market and IPOs are managed through local investment banks, with the Capital Markets Authority (CMA) responsible for regulation and supervision. The CMA acts to enforce market regulation and corporate governance is modelled loosely on prevailing OECD standards although there remains considerable ambiguity in its interpretation (Barako et al., 2006).

2.1.4. Southern Africa

The Johannesburg Securities Exchange in South Africa is the oldest and largest market and was established in 1887. A sophisticated electronic trading system has been adopted since the end of the former open outcry system in 1996. This system was extended to become a regional trading system linking the integrated market of Namibia in 1998 and upgraded in 2002 under the guidance of the London stock exchange to the current Shares Electronically Traded System (SETS). There is a central depository, the Southern African Financial Instruments Clearing and Settlement System (SAFICAS), which is based on technology used in the Swiss stock exchange. There are high levels of corporate governance, following the King I and II reports[4], and international regulatory standards (JSE website, 2009). Namibia is similar in market organization, having shared a colonial past and the associated common legal heritage and institutions. Both South Africa and Namibia are members of the Common Monetary Area (CMA)[5] and South African Customs Union (SACU) (Hearn and Piesse, 2002).

The Botswana stock exchange was established in 1989 as an over-the-counter share market before trading was formalised in 1995 and now functions as a call auction daily from 10:00 am to 12:00 pm. The exchange has 20 listed companies, with the financial sector accounting for over 85% of market

[3] The proportion of issued shares available to the public and not held by incumbent block holders.

[4] The King Reports that regulate corporate governance practices in South Africa is very similar to the UK Cadbury Report and the US Sarbanes–Oxley Act (South African Institute of Directors, 2009).

[5] Common Monetary Area (CMA) countries include Namibia, Swaziland and Lesotho as well as South Africa. Member states currencies are pegged to the Rand and form an economic union.

capitalization. Order flow is through four local brokers and the market provides limited risk diversification opportunities for the small institutional investment community, mostly made up of pension funds (Jefferis, 1995). A fully G30 compliant CSD facilitates payment and settlement. Due to geographical proximity, the Botswana market is heavily influenced by the corporate governance standards in South Africa. This is further reinforced by a number of locally listed blue chip South African firms that follow a high quality regime of governance, accounting and auditing standards.

The Zambian stock exchange was established in Lusaka in 1994 with technical assistance from the International Finance Corporation (IFC) and the World Bank. Trading is by delocalised electronic system, with three brokers. There is a pre-opening call auction between 9:00 am and 10:00 am followed by a continuous daily auction from 10:00 am to 13:00 pm. A fully G30 compliant CSD facilitates payment and settlement and the Securities and Exchange Commission (SEC) has regulatory oversight of the market. However, the evidence in Table 1 suggests that the market is highly concentrated with one stock alone accounting for 32.85% of capitalization and 18.12% turnover. Corporate governance in Zambia is still in its infancy with indigenous firms making up the majority of local listings and the few foreign firms, mostly from South African, list a very small proportion of their overall shares (Old Mutual, 2009). In this market, the formal sector is small and concentrated on the consumer goods, financial and communication industries, as shown in Table 1. In Zambia, the informal sector dominates the economy.

2.2. Liquidity constructs

2.2.1. The bid–ask spread and commission costs

The data on the end of month bid and ask quotes were from Datastream for Morocco, Egypt and South Africa and from Bloomberg for Tunisia. Data were unavailable for Namibia, Botswana, Nigeria and Zambia. There is considerable variation in the length of intraday data with Morocco and Tunisia available for over 15 years and Egypt and South Africa from 2000. Because of inconsistencies between the various data sources some was obtained directly from the markets. The bid–ask spread is calculated using the average of the available monthly quotes and incorporates at a minimum a single month's quote for that month. The average bid–ask spread spanning the quarter is used for the estimate of the spread. This minimizes outliers and averages out the highs or lows resulting from monthly sampling. Following Lesmond (2005) bid–ask spreads that exceed 80% are trimmed as these are potentially errors. The monthly quoted spread is defined as:

$$\text{Quoted spread}_M = 1/2\left[\left(\frac{(\text{Ask}_M - \text{Bid}_M)}{(\text{Ask}_M + \text{Bid}_M)/2}\right) + \left(\frac{(\text{Ask}_{M-1} - \text{Bid}_{M-1})}{(\text{Ask}_{M-1} + \text{Bid}_{M-1})/2}\right)\right] \tag{1}$$

2.2.2. Liu (2006) measure

Daily price and volume data are collected from Datastream. The measure is from Liu (2006) and defined as LM_x which is the standardised turnover-adjusted number of zero daily trading volumes over the prior x months ($x = 1,6,12$), that is

$$LM_x = \left[(\text{Number of zero daily volumes in prior} \times \text{months}) + \frac{1/x \text{ month turnover}}{\text{Deflator}}\right] * \frac{21x}{\text{NoTD}} \tag{2}$$

where x month turnover is the turnover over the prior x months. This is calculated as the sum of the daily turnover over the prior x months, which is the ratio of the number of shares traded over the number of shares outstanding at the end of the day. NoTD is the total number of trading days over the prior x months and Deflator is chosen such that,

$$0 < \frac{{}^{1}\!/_{(x \text{ month turnover})}}{\text{Deflator}} < 1 \tag{3}$$

for all stocks[6]. Given the turnover adjustment (the second term in the brackets in Eq. (2), two stocks with the same number of zero daily trading volumes can be distinguished: the one with the larger turnover is more liquid. Thus the turnover adjustment acts as a tie-breaker when sorting stocks based on the number of zero daily trading volumes over the prior x months. Because the number of trading days per month can vary from 15 to 23, multiplication by the factor (21 × /NoTD) standardises the number of monthly trading days to 21, which makes the liquidity measure comparable over time. The Liu measure, designated LM1 with 1 reflecting the period of measurement i.e. one month, can be interpreted as the turnover-adjusted number of zero daily trading volumes over the prior 21 trading days, which is the approximate average number of monthly trading days. The liquidity measure, LM_x is calculated at the end of each month for each individual stock based on daily data.

2.3. Data: sources

Daily stock closing, bid and ask prices, total number of shares outstanding, traded volumes, dividend per share in local currency and converted into sterling were obtained for Egypt, Morocco and South Africa from Datastream. These variables are from Bloomberg and the national stock exchanges for Tunisia, Nigeria, Botswana, Zambia and Namibia. Using these data, the daily return variance (volatility), market capitalisation, defined as the total number of shares outstanding multiplied by daily closing price, and various liquidity constructs were calculated. The total returns series for each stock were from Datastream for Kenya, Morocco, Egypt and South Africa. Those for Nigeria, Tunisia, Zambia, Botswana and Namibia were constructed using the Standard & Poors method, assuming dividend reinvestment and allowing for dividends, stock splits, rights issues and other corporate activity that may affect a stocks intrinsic value. Exchange rate and UK-Gilt/Treasury yield data, which represents the risk free rate adjusted to take account of monthly excess returns rather than the quoted equivalent annualised rates, are from Datastream. The conversion of the total returns series and prices into sterling and the use of UK-Gilt/Treasury yield rate assume long term parity between individual domestic currencies and sterling. In many cases companies were deleted from the sample owing to either data inconsistencies or the lack of certain variables that make total return calculations impossible. Nigeria is one example where there are 234 listings yet 60 of these do not have data and a further 45 firms have incomplete data and consequently the sample size for Nigeria is 129 firms.

2.4. Data: summary statistics of liquidity measures

The skewness and considerable differences in liquidity in these equity markets are shown in Table 3. This provides a contrast of the mean cross-section values for daily percentage zero returns, stock prices, traded volumes, market capitalisation and bid–ask spreads for the firms within the overall market, the top tier stocks, as ranked by market capitalisation, and for the largest sectors defined in Table 1. The top tier stocks for Egypt, Morocco, Nigeria and South Africa contain 10 firms, while those for Kenya and Tunisia have 5 firms and Botswana and Zambia 3 firms. There is clear evidence of a size and liquidity effect in all the markets, with the mean cross-section capitalizations of the top tier stocks in each case frequently being larger than the aggregate market by several orders of magnitude. Similarly, there are considerable differences between the top tier stocks and the aggregate market in terms of size of the bid–ask spread. For example, the mean bid–ask spread of the top tier is just 3.40% of the mean for the overall market for South Africa. These differences within the markets are further reflected by the differences between industrial sectors. Even taking into account that only the largest sectors, as ranked by market capitalisation in Table 1, have been used there are considerable contrasts. Interestingly, in all markets although the financial sector forms the highest profile listings and a steady source of blue chip listings to the exchanges their liquidity profile is poor as compared to the top tier stocks and often only marginally better than the aggregate market. Percentage daily zero returns and, where available, bid–ask spreads, reveal that in all cases liquidity is only marginally less than the overall market and considerably lower than for the top tier stocks. However, the greatest degree of illiquidity that is consistent across all groups of firms is in Botswana,

[6] Following Liu (2006) a deflator of 1000 is used in constructing estimates for LM1.

Table 3
Summary statistics.
Source: Compiled by authors from Bloomberg, Datastream and National stock exchanges.

				Local market			£UK equivalent		
Country	Start	No. firms by trading activity	Zero return (%)	Price	Volume (thousands)	Market capitalization (millions)	Price	Market capitalization (millions)	Bid–ask spread (%)
North Africa									
Egypt	1998	Financial	48.09	26.22	8044.67	1,026.78	2.75	99.77	4.14
			[50.55]	[23.58]	[4534.04]	[322.50]	[2.74]	[38.10]	[2.90]
		Basic material	46.96	56.37	3345.33	239.66	5.52	23.59	2.59
			[52.17]	[21.45]	[2711.79]	[101.02]	[2.75]	[11.43]	[2.26]
		Consumer	54.64	93.74	399.76	88.48	11.11	9.51	13.95
		non-cyclical	[57.14]	[123.34]	[234.89]	[63.93]	[10.74]	[8.85]	[14.76]
		Industrial	46.07	26.26	2034.54	382.92	2.51	37.78	4.53
			[45.94]	[18.46]	[1159.02]	[180.55]	[1.85]	[19.91]	[4.89]
		Top 10	21.08	91.39	13,247.49	832.02	9.07	82.33	0.77
			[21.21]	[33.45]	[12,518.37]	[357.63]	[4.74]	[51.09]	[0.74]
		121	50.92	42.05	6027.75	1,535.97	4.31	162.45	5.62
			[53.24]	[44.83]	[4760.21]	[789.51]	[4.86]	[117.44]	[6.06]
Morocco	1993	Financial	65.00	449.98	2795.61	3,613.09	28.87	241.15	0.83
			[65.73]	[393.11]	[1361.85]	[2,444.36]	[24.67]	[163.96]	[0.08]
		Consumer-	72.45	106.88	2185.28	759.67	6.84	49.03	0.79
		cyclical	[82.61]	[83.25]	[434.65]	[473.73]	[5.15]	[29.58]	[0.04]
		Diversified	52.10	783.13	287.65	8,906.95	50.38	569.83	1.03
			[48.33]	[733.94]	[108.00]	[9,134.44]	[45.67]	[557.31]	[0.00]
		Industrial	68.42	594.01	57.69	5,647.75	38.25	360.83	0.80
			[66.66]	[525.20]	[17.10]	[5,618.73]	[32.88]	[349.10]	[0.00]
		Top 10	43.82	663.27	4568.47	12,228.62	42.63	785.21	0.17
			[39.55]	[636.16]	[1507.30]	[8,519.74]	[40.36]	[528.93]	[0.00]
		40	66.43	616.07	7071.77	4,045.14	39.62	263.65	0.54
			[66.67]	[635.06]	[5205.65]	[3,077.26]	[39.75]	[200.44]	[0.00]
Tunisia	1991	Financial	59.45	25.82	729.80	130.50	14.29	72.44	2.08
			[60.35]	[22.63]	[593.82]	[107.61]	[11.67]	[57.28]	[1.99]
		Consumer-	60.98	16.44	224.79	46.57	8.63	32.05	3.70
		cyclical	[59.09]	[13.55]	[93.57]	[40.30]	[6.97]	[21.41]	[2.42]
		Consumer	72.33	43.23	59.08	104.78	24.56	50.89	2.85
		non-cyclical	[69.69]	[41.16]	[27.07]	[76.46]	[21.68]	[48.39]	[1.99]
		Top 5	50.82	25.40	324.47	254.76	46.26	131.49	6.40
			[49.09]	[21.65]	[222.34]	[264.31]	[41.48]	[122.81]	[6.43]
		37	64.97	34.65	1084.96	58.59	18.93	103.70	53.37
			[66.04]	[32.02]	[835.74]	[48.28]	[16.02]	[95.10]	[69.13]
West Africa									
Nigeria	2002	Financial	53.61	32.45	2,032,900.25	53,641.83	0.13	300.68	–
			[58.55]	[39.13]	[1,054,456.35]	[27,970.54]	[0.16]	[141.32]	
		Consumer	57.94	17.03	182,111.90	1,956.04	0.07	8.36	–
		non-cyclical	[60.17]	[16.41]	[122,372.26]	[2,112.87]	[0.06]	[8.64]	
		Energy	41.35	82.58	36,095.08	32,299.59	0.36	138.49	–
			[39.67]	[79.76]	[24,145.01]	[34,046.92]	[0.32]	[137.45]	
		Top 10	41.96	12.04	1,537,138.03	123,079.19	0.05	540.25	–
			[43.18]	[7.24]	[920,356.09]	[51,593.87]	[0.02]	[214.07]	
		129	63.67	18.76	2,631,207.67	30,129.70	0.08	132.49	–
			[66.94]	[18.44]	[1,373,235.44]	[25,008.37]	[0.07]	[102.05]	
East Africa									
Kenya	1995	Financial	47.84	29.67	116,329.73	5,249.66	0.24	41.05	4.08
			[49.65]	[17.99]	[35,845.90]	[19,340.63]	[0.19]	[148.60]	[4.03]
		Consumer	69.28	74.88	32,676.73	3,368.45	0.65	29.18	2.96
		non-cyclical	[70.56]	[76.21]	[9836.90]	[12,164.60]	[0.60]	[151.82]	[2.83]
		Industrial	70.55	33.41	6017.40	5,446.07	0.28	39.46	3.07
			[72.85]	[30.25]	[1590.00]	[25,108.37]	[0.24]	[227.83]	[2.70]

(continued on next page)

Table 3 (*continued*)

Country	Start	No. firms by trading activity	Zero return (%)	Local market			£UK equivalent		
				Price	Volume (thousands)	Market capitalization (millions)	Price	Market capitalization (millions)	Bid–ask spread (%)
East Africa									
		Top 5	39.76	39.08	91,439.09	–	0.38	154.17	2.92
			[40.00]	[14.86]	[28,159.00]		[0.18]	[446.72]	[3.24]
		37	60.31	45.01	174,106.53	3,582.61	0.38	31.88	3.50
			[61.63]	[41.10]	[59,870.70]	[16,327.59]	[0.36]	[145.32]	[3.62]
Southern Africa									
South Africa	2000	Financial	48.42	1717.81	615,956.42	714,336.90	1.52	548.30	–
			[47.93]	[1627.15]	[622,400.30]	[5,467,097.31]	[1.54]	[4,672.59]	
		Communication	41.17	1,801.78	103,311.43	1,240,306.64	1.55	931.35	–
			[39.92]	[1,315.63]	[78,310.76]	[7,513,715.89]	[1.52]	[6,494.58]	
		Basic material	39.49	4,367.54	268,319.65	1,706,137.77	3.46	1,281.98	–
			[41.88]	[3,671.98]	[200,649.96]	[13,536,731.66]	[3.01]	[10,420.37]	
		Consumer-cyclical	44.69	1,628.92	279,201.93	466,612.01	1.39	356.69	–
			[44.28]	[1,300.37]	[174,665.35]	[3,142,816.10]	[1.28]	[2,662.86]	
		Consumer non-cyclical	45.45	985.29	246,512.39	255,289.09	0.86	193.51	–
			[45.45]	[796.64]	[247,604.33]	[1,827,363.15]	[0.79]	[1,539.38]	
		Energy	43.88	4,130.46	42,129.91	3,121,798.49	3.31	2,340.72	–
			[44.44]	[2,636.55]	[41,485.32]	[20,758,811.13]	[2.26]	[17,555.67]	
		Industrial	46.81	1,180.60	168,019.15	305,975.59	1.00	232.80	–
			[45.65]	[907.97]	[143,755.51]	[2,217,807.39]	[0.86]	[1,921.39]	
		Top 10	9.35	10,875.53	436,124.70	7,159,093.22	8.66	5,420.18	0.40
			[8.09]	[8,845.80]	[442,050.81]	[50,766,503.99]	[6.82]	[43,196.07]	[0.60]
		273	45.44	1,832.36	1,846,339.16	698,166.17	1.56	529.35	10.07
			[45.11]	[1,375.33]	[1,635,892.97]	[4,991,884.70]	[1.41]	[4,215.62]	[10.38]
Namibia*	1995	Financial	92.96	13.86	725.99	207.70	0.87	19.71	–
			[93.8]	[1.58]	[189.1]	[156.5]	[0.17]	[15.99]	
		7	92.53	8.28	1658.26	206.66	0.59	18.35	–
			[93.48]	[1.65]	[746.24]	[147.90]	[0.17]	[14.55]	
Botswana	1996	Financial	89.43	224.09	9427.84	50,208.04	21.93	4664.87	–
			[90.00]	[150.65]	[6400.21]	[31,531.52]	[16.59]	[3331.14]	
		Consumer non-cyclical	89.40	630.00	1293.33	51,656.72	67.11	5,345.24	–
			[90.48]	[671.11]	[569.17]	[41,913.88]	[73.37]	[4,316.3]	
		Top 3	86.13	335.13	5297.94	14,133.67	32.04	151,475.21	–
			[87.30]	[211.32]	[2634.31]	[11,133.75]	[22.37]	[97,449.5]	
		19	90.49	291.48	11,106.26	37,295.78	29.55	3,530.67	–
			[91.15]	[216.36]	[7466.05]	[23,959.62]	[23.29]	[2,532.89]	
Zambia	1997	Financial	91.74	2,182.70	27,515.11	215,983.31	0.38	32.39	–
			[92.86]	[1,777.02]	[427.6]	[101,942.25]	[0.25]	[17.63]	
		Consumer non-cyclical	86.02	926.08	4439.44	245,914.59	0.13	34.17	–
			[87.27]	[238.55]	[1244.82]	[62,472.12]	[0.03]	[7.87]	
		Industrial	83.87	877.18	1892.49	119,399.79	0.12	16.60	–
			[84.42]	[330.62]	[78.87]	[22,125.33]	[0.06]	[3.95]	
		Top 3	79.44	116.50	6231.29	415,446.40	0.02	58.70	–
			[80.95]	[39.66]	[1159.1]	[119,251.55]	[0.01]	[15.60]	
		18	89.75	981.18	37,883.91	157,404.07	0.16	22.53	–
			[90.91]	[636.55]	[4123.63]	[48,538.56]	[0.14]	[6.61]	

Note: (1) *Indicates Namibian domestic market of 7 locally listed firms. Remaining 22 Namibian firms have primary listings in South Africa and are considered South African.

Namibia and Zambia. Zambia has a value of 89.75% for the aggregate market, falling to 79.44% for the top 3 stocks and Botswana falls from 90.49% for the aggregate market to 86.13% for the top 3 stocks. Namibia is the most illiquid markets with the percentage daily zero returns over 92% for the aggregate local market indicting severe price rigidity. These results form the basis of the critique in this paper regarding the estimation of the cost of equity in African markets using standard techniques that do not take account of either issues relating to market segmentation of the severe illiquidity that exists. The severity of the

illiquidity reduces the variances and covariances of the stocks and leads to the conventional application of CAPM market betas inaccurately in these emerging markets.

3. Empirical model: size and liquidity augmented CAPM

In the spirit of the three-factor CAPM model of Fama and French (1993) this work follows the recent work of Martinez et al. (2005) and Shum and Tang (2005) by modifying the augmented factors to take account of size and liquidity effects that offer improved performance in capturing anomalies across the cross section of stock returns especially prevalent in emerging markets. Thus, in addition to market excess returns, the model is augmented by the excess returns attributed to size (SMB) and to illiquidity (ILLIQ).

The market, size and liquidity factors used in the CAPM are formed from the universe of available stocks and sorted into equally weighted portfolios with rebalancing undertaken in December each year from 2002 to 2008. All stocks are assumed to be held continuously for a further year following rebalancing. The market portfolio itself is the simple arithmetic mean of the cross section of total returns in the universe. The universe is sorted each December, first by each stock's market capitalization into three size ranked portfolios, "Small", "Medium", and "Big", and then each of these is further sorted into another three portfolios based on the liquidity measure. The size factor is formed from the cross-section mean returns of the small-size portfolio minus the big size portfolio and is referred to as the SMB (small minus big) factor, following Fama and French (1993).

Given the Amihud liquidity measure, which focuses on the impact on a stock's price of trading activity, outperforms the turnover construct in capturing the effects of liquidity within the sample markets this is used in the ranking of s stocks into portfolios based on their relative liquidity. This liquidity factor is based on the mean of each of the three "High" illiquidity portfolios within each of the size portfolios, minus the mean of the "Low" illiquidity portfolios and is referred to as the HML (high minus low), following Liu (2006).

The market variable is problematic due to the lack of appropriate regional benchmarks in sub-Saharan Africa (SSA) and it is further complicated by the unreasonable assumption that full market integration would impose on these highly segmented markets. Thus, the North African universe of markets includes Egypt, Tunisia and Morocco. The South African universe includes South Africa and Namibia as they are both members of a currency union and also share a trading platform and legal and regulatory systems. Finally, a sub-Saharan universe includes Nigeria, Kenya, Zambia and Botswana. Market universes formed in this manner minimise the difficulties of including extremely heterogeneous markets within the common integrated market assumption.

Once the three factors have been constructed the three-factor CAPM can be restated as the expected return on a risky portfolio p, in excess of the risk free rate $E(R_p)-R_f$ is a function of (i) excess return on the market portfolio, R_m-R_f; (ii) the difference between the return on a portfolio of small-size stocks and of large-size stocks, SMB; and (iii) the difference between the return on a portfolio of high illiquidity stocks and of low illiquidity stocks, ILLIQ. Therefore, the expected excess returns on a portfolio p of emerging market stocks can be written as

$$E(r_{\mathrm{pt}})-r_{\mathrm{ft}} = \beta_p[E(r_{\mathrm{mt}})-r_{\mathrm{ft}}] + s_i E(\mathrm{SMB}) + h_i(\mathrm{HML}) \tag{4}$$

The equilibrium relation of the Fama and French (1993) three-factor model is stated in terms of expected returns. In order to test the model with historical data, it is necessary to transform Eq. (4) to the following estimating equation:

$$r_{\mathrm{it}}-r_{\mathrm{ft}} = \alpha_i + \beta_i(r_{\mathrm{mt}}-r_{\mathrm{ft}}) + s_i \mathrm{SMB}_t + h_i \mathrm{HML}_t + \varepsilon_{\mathrm{it}} \tag{5}$$

where the variables are described above and $\varepsilon_{p,t}$ is an iid disturbance term.

4. Results

4.1. Summary statistics of the size–liquidity sorted portfolios

The dispersion of stocks on a market by market basis between the nine size–illiquidity sorted portfolios is shown in Table 4. These have been generated for the markets of North and South Africa. An additional

Table 4
Average number of stocks in each of the 9 size–illiquidity portfolios sorted by nationality by year in period: 2002–2008.

Portfolio	S/L	S/M	S/H	M/L	M/M	M/H	B/L	B/M	B/H
Market: North Africa									
Egypt	10.29	6.00	9.00	14.00	8.43	3.00	7.00	2.00	3.00
Morocco	0.93	2.00	3.14	0.00	2.98	6.86	3.00	5.92	6.86
Tunisia	2.00	4.00	1.00	1.00	3.00	6.00	5.00	6.00	4.00
Overall mean:	13.21	12.00	13.14	15.00	14.40	15.86	15.00	13.92	13.86
Market: sub-Saharan Africa (excl. RSA)									
Nigeria	0.00	0.00	0.00	4.72	0.79	0.00	10.82	5.79	0.00
Kenya	10.00	7.00	7.92	8.53	6.00	4.89	0.93	0.99	0.00
Zambia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.92	8.17
Botswana	0.00	3.73	0.86	0.00	4.00	2.77	0.00	0.00	0.00
Overall mean:	10.00	10.73	10.78	13.26	10.79	10.52	11.76	12.70	8.17
Market: South Africa									
South Africa	12.70	14.27	9.19	17.68	14.07	14.27	16.86	13.00	14.71
Namibia	0.00	0.00	4.74	0.00	0.00	0.00	0.00	0.00	0.00
Overall mean:	12.70	14.27	13.93	17.68	14.07	14.27	16.86	13.00	14.71

sub-Saharan Africa market variable has been generated based on the few prevailing regional benchmarks that exist, which excludes South Africa and Namibia, but includes Botswana, Zambia, Kenya and Nigeria. There is an even dispersion of stocks across all size–illiquidity sorted portfolios in South Africa, although the small number of Namibian stocks are all located in the small-size, high illiquidity portfolio. In the North Africa size–illiquidity portfolios there is a relatively even dispersion although Egypt and Tunisia tend to dominate the larger size portfolios while Morocco and Tunisia tend to dominate the more illiquid portfolio. The greatest dispersion occurs in the sub-Saharan Africa case. Nigeria and Zambia dominate the large-size portfolios while Kenya and Botswana are in small to medium size portfolios. Notably, Zambia and Botswana stocks are concentrated in the high illiquidity portfolios emphasising the severe illiquidity present.

Descriptive statistics for all nine size–illiquidity portfolios, the mean industry portfolios, and the zero-cost SMB and ILLIQ portfolios, formed under the assumption of no intrinsic arbitrage opportunities across component stocks, are in Tables 5,6 and 7. Table 5 shows that the average mean returns increase

Table 5
Summary statistics for equally weighted monthly excess returns on 9 portfolios formed on size and illiquidity for period 2002 to 2008.

Portfolio	S/L	S/M	S/H	M/L	M/M	M/H	B/L	B/M	B/H
Market: North Africa									
Mean	0.0200	0.0171	0.0012	0.0227	0.0192	0.0116	0.0205	0.0258	0.0095
Std. dev.	0.0752	0.0520	0.0355	0.0911	0.0520	0.0378	0.0546	0.0522	0.0355
Skewness	0.3693	0.0929	0.6626	0.8201	0.4306	−0.2237	−0.4099	0.3817	−0.6351
Excess kurtosis	3.5889	2.6394	4.3447	4.9198	4.1632	3.4270	4.5507	2.8852	4.9243
Market: sub-Saharan Africa (excl. RSA)									
Mean	0.0414	0.0508	0.0078	0.0292	0.0554	0.0248	0.0259	0.0232	0.0548
Std. dev.	0.1098	0.1294	0.0566	0.0906	0.1645	0.0507	0.0711	0.0756	0.3084
Skewness	1.0623	4.2679	1.8479	0.1375	5.1734	0.4022	−0.0279	1.7870	8.0741
Excess kurtosis	4.1811	28.4699	7.9806	3.5922	37.7099	5.3684	4.4232	13.2611	70.4814
Market: South Africa									
Mean	0.0322	0.0378	0.0345	0.0207	0.0214	0.0220	0.0181	0.0176	0.0197
Std. dev.	0.0909	0.0835	0.0812	0.0823	0.0811	0.0749	0.0804	0.0785	0.0755
Skewness	−0.4408	−0.4169	0.3547	−0.4230	−0.4548	−0.6059	−0.2822	−0.6786	−0.7359
Excess kurtosis	3.1252	2.9430	3.3875	3.4607	3.3583	3.4804	2.8291	3.5500	4.0560

Note: (1) Values in parentheses are standard deviations.
(2) *Indicates ranking by market capitalization.

Table 6
Summary statistics for valuation factors.

	SMB	ILLIQ	MARKET
Market: North Africa			
Panel A: summary statistics for valuation factors			
Mean	−0.0211	−0.0445	0.0167
Standard deviation	0.1098	0.1698	0.0389
Skewness	0.4079	−0.2049	−0.1117
Excess kurtosis	3.7403	4.3973	2.8843
Panel B: correlations for valuation factors			
SMB	100.00%	–	–
ILLIQ	−1.16%	100.00%	–
MARKET	0.32%	−74.21%	100.00%
Market: sub-Saharan Africa (ex. RSA)			
Panel A: summary statistics for valuation factors			
Mean	−0.0076	−0.0127	0.0330
Standard deviation	0.3723	0.3911	0.0526
Skewness	−5.5310	5.0305	0.7647
Excess kurtosis	44.9210	39.8079	4.1513
Panel B: correlations for valuation factors			
SMB	100.00%	–	–
ILLIQ	−74.90%	100.00%	–
MARKET	−22.88%	3.70%	100.00%
Market: South Africa			
Panel A: summary statistics for valuation factors			
Mean	0.0455	0.0016	0.0246
Standard deviation	0.1213	0.0913	0.0746
Skewness	0.1365	−0.0327	−0.5899
Excess kurtosis	3.2288	2.5781	3.3665
Panel B: correlations for valuation factors			
SMB	100.00%	–	–
ILLIQ	53.04%	100.00%	–
MARKET	−1.64%	−43.66%	100.00%

considerably from large to small-size stock portfolios for the markets of South Africa and sub-Saharan Africa. This is also reflected in the measure of volatility, where standard deviations increase dramatically from larger size firm to smaller size firm portfolios. Average returns in small-size stock portfolios tend to be more risky than in larger stock portfolios, but also have higher potential returns. However, the negative value of the mean of the SMB in Table 6 for North Africa and sub-Saharan Africa indicates the likelihood of a reverse size effect found by Fama and French (1993) where returns steadily decrease as stock size increases. Although there is little difference between the low and high liquidity portfolio means across the various market variables, there is an increase in volatility from high illiquidity to low illiquidity stock portfolios. This result is expected given that the often severe illiquidity inhibits price adjustment and returns in reaction to the impact of sudden erratic order flow on stock prices. The evidence in Table 6 shows that there is little correlation between the SMB, ILLIQ and market valuation factors for the market variables in South Africa and sub-Saharan Africa. In contrast, there is some correlation between the illiquidity and market factors in the London, Paris and North African markets. It should be noted that these differences indicate that the implicit assumption of integration on either an intra or inter market basis is tenuous at best. However, the lack of viable alternative methods and the ease of application merit the continued use of this approach.

Table 7 demonstrates the high degree of non-normality for the aggregate market, top tier stocks and industrial sectors. Excess kurtosis is particularly high for Nigeria (45.2449), Zambia (41.4781) and Botswana (75.9508) while there is considerable contrast in the standard deviation, with values of over 15% for Tunisian top tier stocks, Nigerian Consumer non-cyclical, Energy and Overall segments, the Botswana overall market, and the financial sector in Zambia. Interestingly, South Africa's top tier stocks have an

Table 7
Summary statistics for market and sector portfolios for period 2002 to 2008.

Market	Industrial sector	Mean	Std. dev.	Skewness	Ex. kurtosis
Egypt	Financials	2.65%	8.24%	0.337	3.488
	Basic materials	2.49%	9.55%	0.854	3.839
	Consumer non-cyclical	2.09%	7.65%	0.332	3.851
	Industrial	1.64%	8.62%	1.649	8.314
	Overall	2.08%	6.93%	0.260	3.376
	Top 10 stocks	2.55%	7.86%	0.170	2.885
Morocco	Financials	2.09%	5.72%	1.240	5.279
	Consumer-cyclical	1.93%	7.75%	1.603	10.658
	Diversified	2.01%	6.14%	0.538	4.146
	Industrial	0.49%	3.66%	−0.569	3.804
	Overall	1.65%	4.05%	0.393	3.348
	Top 10 stocks	1.73%	5.47%	0.259	4.601
Tunisia	Financials	0.92%	3.70%	0.534	3.967
	Consumer-cyclical	0.41%	5.90%	1.356	10.096
	Consumer non-cyclical	2.71%	11.68%	1.646	8.273
	Overall	0.85%	3.29%	0.236	2.857
	Top 5 stocks	3.02%	17.79%	2.212	14.783
Nigeria	Financials	2.48%	8.56%	1.040	4.725
	Consumer non-cyclical	3.68%	16.44%	5.918	46.730
	Energy	4.87%	17.14%	4.102	26.437
	Overall	4.51%	15.01%	5.923	45.245
	Top 10 stocks	2.76%	9.42%	2.015	14.392
Kenya	Financials	3.50%	9.46%	0.496	4.375
	Consumer non-cyclical	1.42%	6.60%	0.469	4.222
	Industrial	2.25%	7.17%	1.218	8.739
	Overall	2.46%	6.59%	0.008	4.317
	Top 5 stocks	3.55%	9.33%	0.532	4.128
Botswana	Financials	1.19%	3.68%	0.062	2.887
	Consumer non-cyclical	0.84%	6.16%	−0.041	5.335
	Overall	3.01%	17.68%	8.482	75.95
	Top 3 stocks	1.71%	4.79%	0.282	3.407
Zambia	Financials	3.37%	17.44%	5.564	41.171
	Consumer non-cyclical	5.00%	9.31%	0.893	5.480
	Industrial	1.29%	6.26%	0.786	4.973
	Overall	4.29%	14.86%	5.526	41.478
	Top 3 stocks	3.38%	10.61%	0.216	3.603
Namibia	Financials	1.23%	7.25%	1.227	8.151
	Overall	1.18%	5.49%	1.002	5.964
South Africa	Financials	1.66%	6.86%	−0.601	3.762
	Communications	2.15%	7.48%	−0.206	3.850
	Basic materials	2.25%	8.47%	−0.816	5.890
	Consumer-cyclical	2.29%	8.21%	−0.119	3.856
	Consumer non-cyclical	2.35%	7.67%	−0.221	3.359
	Energy	1.82%	7.92%	−0.306	4.901
	Industrial	2.30%	8.03%	−0.684	4.147
	Overall	2.04%	6.87%	−0.697	4.013
	Top 10 stocks	4.11%	32.84%	−1.402	12.962

exceptionally high volatility (32.84%), which probably reflects the depth of markets and their ability to properly reflect investor sentiment and uncertainty over the volatile macroeconomic climate experienced during the sample period. However, the top tier stocks generally show considerable decreases in levels of skewness and kurtosis with the distribution of returns closer to normality than for the overall market.

4.2. Performance of traditional CAPM against three-factor CAPM

Table 8 reports the results from the pooled regression on all nine size–illiquidity sorted portfolios for each of the market variables: North, South and sub-Saharan Africa (SSA). For the South African market

Table 8
Time series regressions using equally weighted monthly contemporaneous market excess returns for 9 portfolios formed on size and illiquidity for period: 2002−2008, for all sample markets.

Portfolio	S/L	S/M	S/H	M/L	M/M	M/H	B/L	B/M	B/H
Market: North Africa									
Panel A: CAPM-adjusted performance									
$\hat{\alpha}$(%)	−0.0053	0.0073	−0.0067	−0.0114	0.0031	−0.0114	0.0025	0.0082	0.0021
	(−1.12)	(1.07)	(−1.39)	(−2.45)	(0.95)	(−2.45)	(0.44)	(2.57)	(0.57)
$\hat{\beta}$	1.5189	0.5866	0.4746	2.0367	0.9615	2.0367	1.0755	1.0531	0.4406
	(12.52)	(4.00)	(5.80)	(12.74)	(10.73)	(12.74)	(7.92)	(12.93)	(4.17)
Adj R^2(1)	0.6122	0.1826	0.2608	0.7529	0.5117	0.7529	0.5823	0.6113	0.2238
Panel B: three-factor CAPM performance									
$\hat{\alpha}$	0.0011	0.0098	−0.0045	−0.0092	0.0021	0.0020	−0.0001	0.0049	−0.0021
	(0.31)	(1.81)	(−1.58)	(−2.54)	(0.58)	(0.68)	(−0.03)	(1.65)	(−0.79)
$\hat{\beta}$	0.8786	0.9739	0.8761	1.2376	1.1247	1.0257	0.7401	1.0269	0.9581
	(7.02)	(6.69)	(8.33)	(9.58)	(7.30)	(9.31)	(6.66)	(9.02)	(9.39)
$\hat{s}$	0.2158	0.1744	0.1560	−0.0114	−0.0263	0.0035	−0.1707	−0.1563	−0.1262
	(4.85)	(2.82)	(6.68)	(−0.35)	(−0.54)	(0.14)	(−6.79)	(−7.36)	(−7.21)
$\hat{h}$	−0.1969	0.1200	0.1243	−0.2466	0.0503	0.1692	−0.1039	−0.0085	0.1593
	(−4.66)	(3.36)	(5.23)	(−6.82)	(1.61)	(7.30)	(−3.02)	(−0.30)	(6.40)
Adj R^2(4)	0.8004	0.3717	0.6421	0.8453	0.5155	0.4822	0.7408	0.7140	0.6395
Market: sub-Saharan Africa (ex. RSA)									
Panel A: CAPM-adjusted performance									
$\hat{\alpha}$(%)	−0.0007	0.0137	0.0062	0.0046	0.0003	0.0168	0.0027	0.0018	−0.0346
	(−0.07)	(1.33)	(0.78)	(0.54)	(0.04)	(2.38)	(0.30)	(0.20)	(−0.96)
$\hat{\beta}$	1.2760	1.1226	0.0493	0.7483	1.6692	0.2420	0.7018	0.6507	2.71
	(3.79)	(2.19)	(0.42)	(2.67)	(3.39)	(1.97)	(3.44)	(5.29)	(1.51)
Adj R^2(1)	0.3663	0.1986	0.0021	0.1788	0.2764	0.0515	0.2607	0.1953	0.2044
Panel B: three-factor CAPM performance									
$\hat{\alpha}$	−0.0041	0.0025	0.0037	0.0054	−0.0032	0.0157	0.0048	0.0035	−0.0097
	(−0.49)	(0.27)	(0.5811)	(0.75)	(−0.42)	(2.18)	(0.76)	(0.41)	(−0.95)
$\hat{\beta}$	1.3331	1.6047	0.1859	0.6329	1.7579	0.3034	0.5402	0.5614	2.0195
	(5.76)	(3.88)	(1.21)	(2.74)	(3.17)	(1.94)	(3.57)	(4.70)	(12.90)
$\hat{s}$	0.0136	0.3275	0.1019	−0.0999	0.0423	0.0461	−0.1288	−0.0652	−0.3630
	(0.28)	(3.05)	(2.37)	(−2.97)	(0.39)	(1.23)	(−4.18)	(−1.67)	(−8.09)
$\hat{h}$	−0.1277	0.1757	0.1034	−0.1686	−0.0736	0.0483	−0.1710	−0.0589	0.3812
	(−3.16)	(2.19)	(3.09)	(−6.77)	(−0.98)	(1.47)	(−6.75)	(−2.14)	(10.85)
Adj R^2(4)	0.5992	0.5749	0.1999	0.4135	0.32	0.0904	0.6313	0.2224	0.9409
Market: South Africa									
Panel A: CAPM-adjusted performance									
$\hat{\alpha}$(%)	0.0036	0.0128	0.0160	−0.0054	−0.0042	−0.0015	−0.0062	−0.0069	−0.0041
	(1.33)	(3.26)	(2.84)	(−2.08)	(−1.69)	(−0.76)	(−1.63)	(−2.12)	(−1.14)
$\hat{\beta}$	1.1600	1.0111	0.7519	1.0633	1.0429	0.9571	0.9873	0.9979	0.9659
	(23.73)	(18.66)	(8.53)	(28.84)	(38.86)	(29.30)	(21.60)	(27.59)	(18.95)
Adj R^2(1)	0.9050	0.8146	0.4713	0.9283	0.9189	0.9073	0.8376	0.8996	0.9111
Panel B: three-factor CAPM performance									
$\hat{\alpha}$	−0.0005	0.0054	0.0036	−0.0035	−0.0043	−0.0035	0.0026	0.0002	0.0021
	(−0.19)	(1.8559)	(1.03)	(−1.51)	(−1.57)	(−1.51)	(0.81)	(0.16)	(0.89)
$\hat{\beta}$	1.0381	0.9515	1.0245	0.9976	1.0146	0.9665	0.9697	1.0333	1.0128
	(26.45)	(26.097)	(13.19)	(24.48)	(34.59)	(22.23)	(14.05)	(46.59)	(28.75)
$\hat{s}$	0.1659	0.2006	0.1065	−0.0026	0.0179	0.0369	−0.1832	−0.1802	−0.1635
	(5.71)	(4.81)	(2.71)	(−0.10)	(0.59)	(1.36)	(−5.41)	(−7.64)	(−7.61)
$\hat{h}$	−0.2365	−0.1216	0.5050	−0.1228	−0.0539	0.0157	−0.0239	0.0751	0.0959
	(−5.71)	(−2.08)	(8.39)	(−3.86)	(−1.46)	(0.41)	(−0.53)	(3.23)	(3.36)
Adj R^2(4)	0.9437	0.8707	0.8533	0.9427	0.9190	0.9103	0.9215	0.9576	0.9586

Notes: (1) Numbers in parentheses are *t*-statistics.
(2) One month *T*-bill risk free rate for month *t*, which is taken as the one month UK-Gilt rate in this case.

variables there is little increase in explanatory power between the one-factor CAPM and the three-factor alternative. This indicates both a considerable amount of intra-market integration and that the cross section of returns is sufficiently explained by a single market premium as opposed to additional size and

liquidity factors. The additional factors in all three markets also act to further reduce the statistical significance of the Jensen alpha, α_p, in the regressions of small-size high illiquidity, medium size low illiquidity and large-size medium illiquidity portfolios.

However, the results for the North Africa and SSA market variables are markedly different from those in South Africa. In North Africa there are significant increases in explanatory power when the size and liquidity factors are included and generally the Jensen alpha, α_p, terms are not statistically different from zero, indicating a good fit with established theoretical CAPM assumptions. However, in the case of SSA the explanatory power is frequently less than those of North Africa. The severe illiquidity affecting the model is highlighted in the adjusted R^2 of 0.2% for the small-size high illiquidity portfolio in the one-factor model, which jumps 19.99% when the size and liquidity factors are included. A similar dramatic increase in explanatory power arises in the large-size high illiquidity portfolio where the adjusted R^2 in the one-factor model is 20.44% and increases to 94.09% in the augmented version. Although the application of this model to highly illiquid markets is questionable, and the implicit assumptions regarding inter and intra asset market integration are tenuous, these are important results in the context of emerging markets, as the vast majority of research on the original CAPM (Sharpe, 1964; Lintner, 1965) has been restricted to developed markets only.

In all cases within Africa the Jensen alpha, α_p, term was not statistically different from zero which is in line with theory. The estimated coefficients on both the market excess return (β) and the illiquidity factor (HML) are large and significant in almost all cases. Those on the size factor-mimicking portfolio (SMB) are smaller in the majority of cases and are only significantly different from zero in the large or small-size company portfolios. The coefficients on the large-size portfolios are negative and statistically significant. The negative sign on the large-size portfolio betas indicates that large firms' returns decrease when the size premium increases, which is the opposite for small firms. This behaviour is not expected and is a contradiction of the well documented "size effect" in the valuation of smaller firms (Martinez et al., 2005) and is also a function of the highly heterogeneous universe of stocks in emerging markets, noted in Table 3. This conflicts with the expected result and does not provide investors with good hedging opportunities. Thus, as with the results for the small-size portfolios, a different valuation method would be needed to price highly illiquid stocks accurately. The estimated coefficients on the illiquidity factor-mimicking portfolios are negative for low and medium illiquidity portfolios indicating that more liquid firms experience a decrease in expected returns when aggregate market illiquidity increases. In general, the coefficients on the low illiquidity and medium illiquidity portfolios are negative, as one would expect, with firms paying lower returns when the illiquidity variable increases. However, the coefficients on the high illiquidity portfolios are positive indicating that these companies pay higher returns when the illiquidity measure increases. The increased explanatory power of these models illustrates that the augmented CAPM is appropriate for illiquid markets and thus appropriate in this context (Table 9).

4.3. Modelling country and industry portfolios and cost of equity estimation

Table 10 reports estimates of the cost of equity calculated from the expected returns for each country and industry regression. It should be noted that the estimates for each market are given alongside the market universe from which they have been calculated. The high cost of equity for these markets is used as the discount factor and applied to future cash flows in project valuation. The cost of equity is calculated from the annualised combination of the total risk premium, which is the sum of market, size and illiquidity premiums, with the 3 month UK Treasury rate a proxy for the risk free rate.

4.3.1. Average returns in North Africa

The inclusion of the size and liquidity factors within the three-factor model causes increases in explanatory power in all cases. Interestingly, in almost all industries in all three North African countries the coefficients on the size premium are small and frequently statistically insignificant, whereas those on the liquidity premium are large and significant. This supports the claim that liquidity is an important variable driving the returns process. However, the effect of severe illiquidity and price rigidity reduces the explanatory power of the model, such as in the Tunisian consumer non-cyclical industry. The adjusted R^2 of the one-factor CAPM is less than 1% and rises to a meagre 4.24% when the size and liquidity factors are

Table 9
Pooled cross-section regression for equally weighted monthly excess returns on country portfolios with size and illiquidity for 1996 to 2007.

		Finance	Comm.	Basic materials	Cons. cyclical	Cons. non-cyclical	Diversified	Energy	Ind.	Overall	Top stocks
Market: North Africa											
Egypt	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	−0.0016	–	−0.0035	–	−0.0075	–	– –	−0.0089	−0.0064	0.0020
		(−0.33)		(−0.43)		(−1.54)			(−1.39)	(−1.95)	(0.24)
	$\hat{\beta}$	1.6877	–	1.7002	–	1.6981	–	– –	1.5123	1.6370	1.4139
		(13.81)		(7.64)		(13.15)			(6.61)	(22.44)	(10.38)
	Adj R^2(1)	0.6299	–	0.4734	–	0.7413	–	– –	0.4591	0.8451	0.4849
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	0.0003	–	−0.0052	–	−0.0053	–	– –	−0.0079	−0.0046	−0.0015
		(0.05)		(−0.61)		(−1.09)			(−1.24)	(−1.58)	(−0.25)
	$\hat{\beta}$	0.9806	–	1.2987	–	1.3305	–	– –	1.2502	1.2431	0.9669
		(4.98)		(4.78)		(9.64)			(4.42)	(16.34)	(4.18)
	$\hat{s}$	−0.0053	–	−0.1364	–	0.0537	–	– –	0.0069	0.0268	-0.2291
		(−0.07)		(−1.77)		(1.07)			(0.14)	(1.05)	(−3.39)
	$\hat{h}$	−0.2183	–	−0.1243	–	−0.1133	–	– –	−0.0809	−0.1215	−0.1385
		(−4.58)		(−2.17)		(−4.70)			(−1.38)	(−6.85)	(−2.77)
	Adj R^2(4)	0.7150	–	0.5079	–	0.7708	–	– –	0.4575	0.8849	0.6186
Tunisia	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	0.0034	–	–	0.0020	0.0274	–	– –	– –	0.0039	0.0157
		(0.79)			(0.31)	(1.82)				(1.06)	(0.72)
	$\hat{\beta}$	0.3467	–	–	0.1223	−0.0168	–	– –	– –	0.2801	0.8783
		(3.61)			(0.83)	(−0.05)				(2.97)	(2.00)
	Adj R^2(1)	0.1221	–	–	0.0065	0.00003	–	– –	– –	0.0995	0.0251
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	0.0031	–	–	0.0022	0.0301	–	– –	– –	0.0040	0.0121
		(0.79)			(0.35)	(1.63)				(1.08)	(0.59)
	$\hat{\beta}$	0.6996	–	–	0.4482	0.6181	–	– –	– –	0.6095	1.6937
		(5.09)			(2.15)	(1.57)				(5.25)	(2.28)
	$\hat{s}$	0.0385	–	–	0.0524	0.2165	–	– –	– –	0.0517	−0.0533
		(1.23)			(0.97)	(1.65)				(1.74)	(−0.35)
	$\hat{h}$	0.1090	–	–	0.1007	0.1966	–	– –	– –	0.1018	0.2515
		(3.33)			(2.51)	(2.18)				(4.07)	(1.72)
	Adj R^2(4)	0.2292	–	–	0.0178	0.0424	–	– –	– –	0.2358	0.0639
Morocco	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	0.0079	–	–	0.0054	–	0.0119	– –	-0.0022	0.0078	0.0083
		(1.53)			(0.89)		(1.88)		(−0.54)	(1.84)	(1.32)
	$\hat{\beta}$	0.7742	–	–	0.8284	–	0.4887	– –	0.4279	0.5290	0.5497
		(6.47)			(4.97)		(3.31)		(3.99)	(6.07)	(3.78)
	Adj R^2(1)	0.2679	–	–	0.1628	–	0.0841	– –	0.1972	0.2501	0.1432
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	0.0048	–	–	0.0029	–	0.0084	– –	−0.0050	0.0046	0.0029
		(1.05)			(0.44)		(1.54)		(-1.19)	(1.31)	(0.58)
	$\hat{\beta}$	1.1887	–	–	1.3744	–	0.7329	– –	0.7276	0.9247	0.8755
		(7.01)			(3.21)		(3.44)		(5.84)	(7.57)	(5.69)
	$\hat{s}$	−0.0889	–	–	−0.0431	–	−0.1348	– –	-0.0911	−0.0961	−0.2029
		(−2.06)			(−0.66)		(−3.26)		(−3.43)	(−2.99)	(−4.54)
	$\hat{h}$	0.1277	–	–	0.1684	–	0.0749	– –	0.0922	0.1219	0.0999
		(3.51)			(1.94)		(1.71)		(2.73)	(4.40)	(2.86)
	Adj R^2(4)	0.3478	–	–	0.2097	–	0.1434	– –	0.3422	0.4267	0.3423
Market: sub-Saharan Africa (excl. RSA)											
Nigeria	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	−0.0110	–	–	–	−0.0152	–	0.0110	– –	-0.0101	0.0018
		(−1.56)				(−1.28)		(0.59)		(−1.49)	(0.18)
	$\hat{\beta}$	1.0856	–	–	–	1.5752	–	1.1409	– –	1.2369	0.7865
		(4.35)				(2.45)		(3.23)		(4.11)	(4.44)
	Adj R^2(1)	0.4385	–	–	–	0.2451	–	0.1118	– –	0.5052	0.1836

(continued on next page)

Table 9 (*continued*)

		Finance	Comm.	Basic materials	Cons. cyclical	Cons. non-cyclical	Diversified	Energy	Ind.	Overall	Top stocks
Market: sub-Saharan Africa (excl. RSA)											
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	−0.0129	–	–	–	−0.0232	–	0.0139	– –	-0.0127	0.0052
		(−2.33)				(−1.42)		(0.66)		(−1.96)	(0.57)
	$\hat{\beta}$	1.1149	–	–	–	1.9059	–	0.9848	– –	1.3054	0.5949
		(7.54)				(2.46)		(2.80)		(4.92)	(4.05)
	$\hat{s}$	0.0048	–	–	–	0.2208	–	−0.1145	– –	0.0339	−0.1430
		(0.21)				(1.07)		(−1.44)		(0.56)	(−3.02)
	$\hat{h}$	−0.0784	–	–	–	0.0971	–	−0.1064	– –	−0.0491	−0.1456
		(−4.11)				(0.64)		(−1.86)		(−1.19)	(−4.74)
	Adj R^2(4)	0.5690	–	–	–	0.3498	–	0.1188	– –	0.6029	0.3313
Kenya	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	0.0111	–	–	–	−0.0008	–	– –	0.0141	0.0072	0.0151
		(1.22)				(−0.12)			(1.54)	(1.097)	(1.39)
	$\hat{\beta}$	0.7239	–	–	–	0.4543	–	– –	0.2557	0.5306	0.6201
		(2.73)				(2.38)			(1.12)	(2.42)	(2.12)
	Adj R^2(1)	0.1519	–	–	–	0.1207	–	– –	0.0235	0.1691	0.1112
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	0.0102	–	–	–	−0.0029	–	– –	0.0122	0.0059	0.0145
		(1.37)				(−0.47)			(1.60)	(1.09)	(1.55)
	$\hat{\beta}$	0.6862	–	–	–	0.5134	–	– –	0.3132	0.5384	0.5723
		(3.22)				(2.37)			(1.28)	(2.49)	(2.57)
	$\hat{s}$	−0.0470	–	–	–	0.0307	–	– –	0.0335	-0.0084	−0.0536
		(−0.87)				(0.75)			(0.55)	(−0.21)	(−1.16)
	$\hat{h}$	−0.1398	–	–	–	−0.0339	–	– –	-0.0115	−0.0777	−0.1421
		(−3.61)				(−1.17)			(−0.23)	(−2.88)	(−3.79)
	Adj R^2(4)		–	–	–	0.2240	–	– –	0.0498	0.3369	0.3052
Botswana	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	0.0068	–	–	–	0.0084	–	– –	– –	-0.0152	0.0141
		(1.73)				(1.01)				(−0.73)	(2.57)
	$\hat{\beta}$	0.1570	–	–	–	1.15E-05	–	– –	– –	1.3768	0.0952
		(1.58)				(0.01)				(1.26)	(0.68)
	Adj R^2(1)	0.0388	–	–	–	0.0000	–	– –	– –	0.1578	0.0109
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	0.0068	–	–	–	0.0091	–	– –	– –	-0.0009	0.0136
		(1.73)				(1.08)				(-0.16)	(2.21)
	$\hat{\beta}$	0.1553	–	–	–	−0.0257	–	– –	– –	0.9846	0.1325
		(1.39)				(−0.19)				(5.039)	(0.82)
	$\hat{s}$	−0.0007	–	–	–	−0.0152	–	– –	– –	-0.2039	0.0297
		(−0.04)				(−0.42)				(-6.42)	(0.80)
	$\hat{h}$	0.0022	–	–	–	0.0037	–	– –	– –	0.2262	0.0393
		(0.13)				(0.12)				(9.62)	(1.33)
	Adj R^2(4)	0.0157	–	–	–	0.0119	–	– –	– –	0.9078	0.0193
Zambia	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	−0.0044	–	–	–	0.0376	–	– –	0.0086	0.0099	0.0126
		(−0.37)				(2.58)			(0.95)	(1.22)	(0.87)
	$\hat{\beta}$	1.1559	–	–	–	0.3723	–	– –	0.1301	1.0028	0.6445
		(1.74)				(1.68)			(0.96)	(1.82)	(2.99)
	Adj R^2(1)	0.1109	–	–	–	0.0326	–	– –	0.0119	0.1157	0.0916
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	−0.0062	–	–	–	0.0349	–	– –	0.0078	0.0052	0.0106
		(−0.55)				(2.25)			(0.83)	(0.51)	(0.69)
	$\hat{\beta}$	1.2466	–	–	–	0.5232	–	– –	0.1929	1.2354	0.7758
		(1.93)				(1.96)			(1.22)	(1.81)	(3.11)
	$\hat{s}$	0.0657	–	–	–	0.1111	–	– –	0.0501	0.1653	0.1022
		(0.91)				(1.86)			(1.56)	(1.46)	(1.49)
	$\hat{h}$	0.0573	–	–	–	0.1057	–	– –	0.0661	0.1275	0.1244
		(0.88)				(2.14)			(2.37)	(1.58)	(2.13)
	Adj R^2(4)	0.0974	–	–	–	0.1037	–	– –	0.0499	0.1656	0.1608

Table 9 (*continued*)

		Finance	Comm.	Basic materials	Cons. cyclical	Cons. non-cyclical	Diversified	Energy	Ind.	Overall	Top stocks
Market: South Africa											
Namibia	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	−0.0007	–	–	–	–	–	– –	– –	0.0015	– –
		(−0.11)								(0.33)	
	$\hat{\beta}$	0.5249	–	–	–	–	–	– –	– –	0.4229	– –
		(5.56)								(6.58)	
	Adj R^2(1)	0.2836	–	–	–	–	–	– –	– –	0.3221	– –
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	−0.0035	–	–	–	–	–	– –	– –	0.0002	– –
		(−0.58)								(0.05)	
	$\hat{\beta}$	0.6070	–	–	–	–	–	– –	– –	0.4802	– –
		(4.91)								(5.52)	
	$\hat{s}$	0.0117	–	–	–	–	–	– –	– –	-0.0065	– –
		(0.19)								(−0.14)	
	$\hat{h}$	0.1529	–	–	–	–	–	– –	– –	0.1075	– –
		(1.42)								(1.34)	
	Adj R^2(4)	0.3014	–	–	–	–	–	– –	– –	0.3295	– –
South Africa	Panel A: CAPM-adjusted performance										
	$\hat{\alpha}$(%)	−0.0049	−0.0013	0.0018	−0.0028	−0.0008	–	0.0042	-0.0022	-0.0021	-0.0098
		(−2.15)	(−0.38)	(0.20)	(−0.68)	(−0.29)		(0.52)	(-0.87)	(-2.92)	(-0.22)
	$\hat{\beta}$	0.8744	0.9255	0.8384	1.0439	0.9858	–	0.5683	1.0229	0.9179	2.0719
		(24.78)	(20.87)	(6.59)	(23.55)	(27.87)		(4.55)	(31.95)	(39.78)	(2.67)
	Adj R^2(1)	0.9034	0.8509	0.5395	0.8996	0.9181	–	0.2783	0.9017	0.9912	0.2121
	Panel B: three-factor CAPM performance										
	$\hat{\alpha}$	−0.0047	−0.0015	0.0105	−0.0038	−0.0006	–	0.0133	-0.0064	-0.0015	0.0276
		(−1.83)	(−0.40)	(1.31)	(−0.9431)	(−0.21)		(2.02)	(-2.34)	(-2.09)	(0.83)
	$\hat{\beta}$	0.8231	0.9157	0.9638	0.9923	0.9834	–	0.6911	1.0712	0.9252	2.0772
		(24.55)	(18.46)	(8.08)	(17.65)	(20.77)		(5.69)	(28.19)	(37.69)	(2.43)
	$\hat{s}$	0.0254	0.0109	−0.2665	0.0533	−0.0020	–	-0.2749	0.0620	-0.0175	-0.8277
		(1.25)	(0.29)	(−4.12)	(1.88)	(−0.07)		(-4.14)	(2.59)	(-1.68)	(-1.45)
	$\hat{h}$	−0.0974	−0.0187	0.2482	−0.0994	−0.0043	–	0.2436	0.0872	0.0143	0.0509
		(−2.76)	(−0.39)	(2.52)	(−2.09)	(−0.08)		(2.02)	(2.30)	(1.14)	(0.10)
	Adj R^2(4)	0.9109	0.8476	0.6281	0.9044	0.9161	–	0.3819	0.9267	0.9916	0.2848

Notes: (1) The risk free rate is the three month UK treasury/Gilt rate adjusted for monthly values.
(2) Numbers in parentheses are Newey–West HAC covariance adjusted *t*-statistics.

included. Although this represents a sizeable jump in absolute terms it does question the use of OLS estimation in modelling highly illiquid series.

In general, the adjusted R^2 indicates the model has reasonable explanatory power across the North African markets. However, despite the apparent fit of the model there are some inconsistencies in the estimates of the cost of equity, in Table 10. As expected, Egypt as the least developed market, has the highest cost of equity across all industry sectors and even the top tier stocks. Costs of equity are greater than 30% for all sectors and 33.52% for the top tier blue chip stocks. The more developed Moroccan market has a wider dispersion of cost of equity between the various industrial sectors. This ranges from 15.43% and 17.26% for the industrial and diversified sectors to 25.37% for the consumer-cyclical sector. The top tier stocks have a cost of equity of 20.88% compared to an aggregate market value of 18.63%. Finally, the highly developed Tunisian market exhibits the greatest dispersion of cost of equity between sectors. Values range from 1.70% for the consumer non-cyclical industry to 11.19% for the finance sector. However, the greatest difference is between the top stocks (29.13%) and the overall market (9.21%). These results support Ben Naceur and Chaibi (2005) although the wide dispersion of cost of equity estimates in this case does question both the applicability of this pricing model to the very small and highly illiquid Tunisian market and the controversial underlying assumption of an integrated North African market universe. This is especially an issue given that a significant proportion of trading in Tunisia is undertaken by call auction which is fundamentally different from the continuous systems of Morocco and Egypt.

Table 10
Cost of equity estimates derived from multifactor regression (%).

Market sector	North Africa			Sub-Saharan Africa (Excl. RSA)				South Africa	
	Egypt	Tunisia	Morocco	Nigeria	Kenya	Zambia	Botswana	Namibia	South Africa
Finance	32.13	11.19	24.03	55.41	36.33	59.22	8.62	22.95	30.77
Communications									33.03
Basic materials	38.13								15.60
Consumer-cyclical		5.69	25.37						38.47
Consumer non-cyclical	32.08	1.70		88.71	25.92	23.69	0.11		34.44
Diversified			17.26						
Energy				50.66					5.75
Industrial	32.00		15.43		16.03	9.06			42.11
Top stocks	33.52	29.13	20.88	32.90	30.99	35.53	6.74		13.36
Overall	33.11	9.21	18.63	63.82	28.07	56.83	46.69	17.28	31.41

Notes: (1) Annualised cost of equity estimates generated at 12/2008 from the total risk premium.
(2) The UK 3 month Gilt/Treasury rate is used in each case for risk free rate.
(3) Top stocks refers to the top stocks as ranked by market capitalization from the overall market universe. It refers to the top 10 stocks for Egypt, Morocco and South Africa, the top 5 stocks for Kenya, Botswana and Tunisia, and the top 3 stocks for Zambia. The numbers of top stocks in each case are chosen on criteria of data availability and the number of stocks in the overall universe.

4.3.2. Average returns in the sub-Saharan African markets

As with the North African markets, the inclusion of the additional size and liquidity factors causes increases in explanatory power in both the overall and top tier stocks in all sub-Saharan markets. The greatest increases arise from the added size factor in the overall markets of Botswana, which causes a jump in adjusted R^2 of 15.77% to 90.77% and for Nigerian top tier stocks where the adjusted R^2 jump from 18.36% to 33.13% following the inclusion of the liquidity factor. In general, the greatest difference in the levels of explanatory power arises within Nigeria and Botswana where the adjusted R^2 for the top tier stocks is considerably lower than those for the overall market. This suggests that the high degree of segmentation and the concentrated profile of these markets between the large and liquid blue chip stocks and the small and severely illiquid remainder. Compared with the evidence from the aggregate market the profiles of the top tier stocks are quite different. Top tier stock returns across the sample appear to be better explained by the addition of the liquidity factor alone with the size factor statistically insignificant. However, despite the segmentation within the sub-Saharan market universe the levels and differences in the cost of equity are as expected. The aggregate Nigerian market has the highest at 63.82% that drops to 32.90% for the top tier stocks. Botswana and Zambia, which have similar size differences in intra-market illiquidity also have lower costs of equity in the overall market for the top stocks. Botswana falls from an aggregate value of 46.69% to 6.74%, and Zambia from 56.83% to 35.53%. The very low levels of top stocks in Botswana is probably due to the presence of many blue chip South African mining and finance companies that have secondary listings on the Gabarone exchange. These adhere to the high regulatory and governance standards in place in their primary listing on the Johannesburg Stock Exchange. In addition, the financial sectors in Botswana, Zambia, and Kenya have the highest costs of equity of all industries with the sole exception of Nigeria where the consumer non-cyclical industry (88.71%) surpasses the financial sector (55.41%).

4.3.3. Average returns in South Africa and Namibia

Table 9 reports the results from South Africa and Namibia and again provides evidence of intra-market segmentation. There is a general decrease in the adjusted R^2 between the overall South African market and South African top tier stocks as well as with the overall Namibian market. Generally the explanatory power of the one-factor CAPM is sufficient with only incremental increases in adjusted R^2 after including the size factor in South African top stocks and the liquidity factor in Namibia. The cost of equity in the aggregate South African market is 31.41% which significantly decreases to 13.36% for the top ten stocks. In contrast, Namibia has a value of 17.28%. While these values are high, Correia and Uliana (2004) find costs of equity using a one-factor CAPM on a similar scale. However, there is considerable dispersion in the cost of equity

between sectors, with the energy (5.75%) and basic materials (15.60%) sectors in South Africa having the lowest values and consumer-cyclical (38.47%) and industrial (42.11%) having the highest.

5. Conclusions

This study proposes a size and liquidity augmented capital asset pricing model to explain the cross section of expected returns in emerging markets and is the first such study on a sample of African markets. The sample includes Morocco, Tunisia and Egypt in North Africa, Kenya, Botswana, Nigeria and Zambia in sub-Saharan Africa plus Namibia and South Africa. There are considerable differences between markets in terms of corporate governance and regulation with the most developed regimes being those in the North Africa group and in South Africa. Illiquidity series were constructed on a time series cross-section basis and augment the Fama and French (1993) risk-adjusted CAPM. This model is then used to calculate cost of equity estimates on samples that include top tier stocks, industrial sectors and the aggregate markets for these countries.

This study presents substantial evidence regarding the importance of firm size and liquidity in pricing state variables. Considerable improvements are made in explaining the cross section of stock returns by including the size and liquidity factors, which is of particular importance in emerging markets where illiquidity is a common issue. The evidence suggests that costs of equity for the aggregate markets are highest in Nigeria and Zambia but lower in South Africa and Egypt and lower still in Kenya and Botswana. The lowest costs of equity are in markets in Namibia, Tunisia and Morocco. The greatest difference in costs of equity between the top tier blue chip stocks and the aggregate markets in Botswana and South Africa although there are smaller differentials in Nigeria and Zambia. This illustrates the significant segmentation present within markets between the top level blue chip stocks, which can access international capital markets and commonly adhere to the highest levels of corporate governance, and the aggregate market. Equally, the frequently high costs of equity of the various national financial sectors in the sample demonstrate that this industry is not necessarily the best from which exchanges can actively seek to attract new listings. This evidence also lends further support to the benefits of effectively enforced regulation and corporate governance regimes where the markets of Namibia, South Africa, Tunisia and Morocco have the lowest costs of equity and the highest levels of regulation and market transparency. It is clear that firms raising external finance through the stock market in these countries are at a distinct advantage compared to those in Nigeria and Zambia where the very high costs of equity inhibit industrial expansion and make otherwise profitable projects unviable.

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